

COMMONWEALTH OF VIRGINIA



Information Technology Resource Management Standard

PLATFORM ARCHITECTURE

Virginia Information Technologies Agency (VITA)

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Preface

Publication Designation

ITRM Standard PLA 140-01: Platform Architecture

Subject

Platform architecture acquisition and use requirements

Effective Date

The Information Technology Investment Board (ITIB) approved the platform requirements as specified herein when it approved the Platform Architecture Report on 3-3-2004. To accurately reflect the version of the requirements presented in this document, the effective date for this document has been set as the original date of approval of requirements by the ITIB. When these requirements undergo a comprehensive review and revision, the revision's effective date will reflect the date the revisions were approved by the ITIB.

Supersedes

None

Scheduled Review:

Reviews are to be done twice annually for personal computing requirements and once annually for server and storage requirements. The greater frequency of reviews for personal computing architecture are due to the more rapidly changing technologies. Review cycles coincide with the effective date.

Authority

Code of Virginia, §2.2-2007 (Powers of the CIO)

Code of Virginia, § 2.2-2010 (Additional powers of VITA)

Code of Virginia, §2.2-2458 (Powers and duties of the board [ITIB])

Scope

The requirements in this standard apply to all state executive branch agencies including institutions of higher education. Executive branch agencies are referred to as "agencies" in this document.

Purpose

To establish technical standards and requirements, which govern the acquisition, use and management of personal computing, server and storage technologies by state executive branch agencies.

General Responsibilities

The Chief Information Officer of the Commonwealth (CIO)

Directs the formulation and promulgation of ITRM standards

The Virginia Information Technologies Agency (VITA)

Drafts the ITRM standard

Updates the ITRM standard

Uses requirements in the ITRM standard when establishing contracts, reviewing procurement requests, developing services and managing services

The Information Technology Investment Board (ITIB, the Board)

Approves the standard requirements or delegates approval to the CIO

Executive Branch Agencies

Provide input during the development of requirements and the drafting of the standard

Provide input for the review and updating of standard

Comply with the requirements established

Use standards information in planning for the acquisition and modification of platforms

Apply for waivers when necessary (e.g., for controlling costs or qualifying for funding).

Related ITRM Policies, Standards, and Guidelines

ITRM Policy PLA 139-01, Platform Policy

ITRM Guideline PLA 141-01, Platform Guideline

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Overview

This document provides the Information Technology Resource Management (ITRM) standards for the acquisition and use of computing platforms by Commonwealth executive branch agencies. The platforms addressed by this standard include servers, personal computing devices and storage systems. This standard contains specific requirements that affect the decisions made by executive branch agencies involving platform acquisition, platform leasing, seat management contracting, application service contracting, operating system selection, basic software acquisition (e.g., for desktops and laptops), server to storage connectivity, storage design decisions, and platform refreshing. A related document, the *ITRM Platform Policy*, addresses the rationale for establishing platform requirements.

This standard is one part of the Commonwealth's Enterprise Technical Architecture. Its development also supports mandates of the 2003 General Assembly that centralized responsibilities for platforms and platform services for executive branch agencies. These two efforts support the effective and efficient use of platform resources to address Commonwealth business requirements.

The Enterprise Technical Architecture is divided into eight domains or areas of technology. The platform domain is one of the eight technical domains. The eight domains are as follows:

1. Network
2. Platform
3. Database
4. Middleware
5. Application
6. Information
7. Systems Management
8. Security

Platform Architecture

This standard includes requirements for three components of the [platform architecture](#)¹: [personal computing](#), [servers](#), and [storage](#)². Other components may be added in the future. Questions related to platform architecture may be addressed to Policy, Practices and Architecture staff members in Strategic Management Services Directorate of the Virginia Information Technologies Agency³ (VITA).

¹ In the electronic version of this document, the Glossary entries are hyper-linked to the first occurrence of the entry in the document text. In the printed version, a hyper-linked entry appears as an underlined word in the text.

² The Platform Architecture Report contains considerable background information for all requirements. This information will not be repeated here.

³ The VITA Strategic Management Services Directorate's reception phone number is: 804-225-3622.

Requirements

Requirements presented in this document are of two types: technical specifications presented in **trend tables** that indicate what technologies may be acquired at a particular point in time, and **requirement statements** that typically address a single issue and include one or more required actions.

The trend tables and requirement statements are reviewed regularly and updated. The requirement statements typically indicate roles and responsibilities for achieving desired architectural cost savings, studying issues to ensure cost efficiencies, or accomplishing legislated requirements. The review schedule for tables is annual or more often if indicated.

The requirements for the platform components are presented in this standard in four categories.

Requirements for:

- Personal Computing
- Server Hardware and Operating Systems
- Storage Solutions
- All Platforms

Requirements Provided in Technology Trend Tables

The technical trend table requirements are presented in four labeled columns. Each table also has specific subtopics that further clarify the intended use of the technology. The latest platform standard with revised trend tables is available online after changes are approved at <http://vita.virginia.gov/docs/ea-reports.cfm>.

The column labels provide a roadmap for the Commonwealth executive branch agencies including VITA (e.g., VITA provides state purchasing contracts for agency use). The labels and their interpretation follow:

Obsolescent: When a technology is designated as obsolescent, this indicates that an agency shall not acquire the technology for the specified purpose (e.g., single application platform versus consolidation platform). If the agency presently uses the technology, the agency must develop plans to discontinue use as soon as possible.

The agency would typically include one or more activities in its strategic plan that would result in examining options for replacing the technology. The priority of the replacement relative to other agency initiatives would depend on the risks associated with lack of support, poor performance, or other problems. If the technology were designated as obsolete only because of a desire to simplify the state's architecture for the purpose of reducing enterprise costs, costs for replacing the technology would have to be justified by savings realized (e.g., savings from reduced support costs).

Transitional: When a technology is designated as transitional, agencies may use the technology while transitioning to a strategic technology. An agency using a transitional technology shall investigate strategic alternatives and plan for a future migration.

A technology may be transitional because: the vendor is planning to discontinue support for the technology in the near future; the Commonwealth is streamlining the technologies to be supported centrally (e.g., to reduce support costs for agencies); newer technologies offer considerable advanced features for addressing business problems, or the technology is no longer an efficient, effective tool. The agency must weigh risks, costs, and benefits of continuing to use the technology against the risks, costs, and benefits of migration when determining the actions it will take and the timeline. The agency's information technology strategic plan would initially provide for an examination of the costs and benefits of alternatives given the agency's specific uses of the technology.

- **Strategic:** When acquiring new technologies, whether for a new application, a new use, a capacity expansion, a major change in an old application, a replacement of aging equipment, a cost-effective upgrade, or an increase in capacity, agencies shall acquire the technologies listed in the strategic category or provide proof to show why it is not cost effective to do so. **To acquire a technology that is not strategic, the agency must request a waiver based on the proof developed.**

Strategic technologies may be a software brand and version, a hardware feature, a service, a hardware type, or a tool. Strategic technologies are selected to reduce risks, promote cost competition, reduce support costs, and/or avail agencies of new tools to address business needs more effectively. When technologies are changing frequently, technologies may be moved in and out of the strategic category more rapidly. An agency may request that a new technology be evaluated for inclusion in the strategic category.

When evaluating options or writing requests for proposals (RFPs) agencies must consider the appropriate strategic technologies as solutions. Except when requesting information to support a waiver request, agencies shall require that responders to their requests for information (RFIs) or RFPs employ or provide strategic technologies. This is necessary whether the agency is requesting information, proposals for services (e.g., hosting or turn-key services) or products. When obtaining responses for evaluating strategic and non-strategic alternatives, the agency must incorporate total costs into alternative comparisons and not just base decisions on acquisition costs.

Competition is designed into strategic technology choices. Agencies may lower their costs by maximizing their use of strategies to ensure competition. For example, for high-end consolidation platforms, an agency RFP could solicit acquisition, maintenance, development, migration, training and operation and/or maintenance costs for each of the three high-end consolidation choices indicated in the standard.

- **Emerging:** Emerging technologies have defined risks and/or higher costs which are associated with them. They may be very promising new technologies or alternatives to a technology chosen as strategic. Any agency may study or pilot an emerging technology or request an exception to use the technology.

The results of agency studies and pilots should be shared with Enterprise Architecture staff. One agency's evaluative use of an emerging technology may provide the data needed to move the technology to strategic. Also, the use of the technology by

another state or business that demonstrates clear resolution to all risks that are of concern to Commonwealth agencies may be sufficient argument to provide an exception for a particular use. When the technology is emerging because of cost issues, a study may be needed to address this.

Agencies interested in emerging technologies for meeting their business needs should ask vendors for evidence of successful use in situations with similar scope, type, size, performance requirements, capacity requirements, etc. Agencies shall not use this technology in more than a test mode without strong evidence of successful and cost-effective implementation(s) for a similar use. The test use results or other evidence must be submitted as part of the waiver request. The arguments of one agency that has been granted a waiver may be used by other agencies along with documentation of similar circumstances.

Platform software upgrades shall not be made without thorough cost analysis and testing. The cost analysis arguments must include business benefits. The test design should address all important users, uses, and associated changes. The more people and processes that are affected by proposed alternatives, the more stringent shall be the design and scope of the evaluation. Evaluation designs and results must be documented so that those using the results to change state policy may assess the quality and thoroughness of the study.

Requirement Statements

The second format for providing requirements is requirement statements. These statements may elaborate on a requirement in a technical trend table or may introduce a related requirement for how agencies or central services will address architectural goals.

Requirements by Platform Architecture Component

Personal Computers

Requirements in the area of personal computing may address procedures to be used or items that may be acquired to meet agency business needs. Examples of items include software, processing hardware, monitors, or peripherals. Example procedures include how decisions are to be made regarding personal computing components, and how agency business needs are assessed. Personal computing devices addressed in this standard include desktop computers, desktop monitors, mobile computers (e.g., notebooks) and personal digital assistants (PDAs).

Personal Computing Software

Personal computing software includes the operating system and productivity software. Most government workers are knowledge workers. The productivity software typically used by knowledge workers is word processing, spreadsheet, presentation, Internet browser, and mail client software. A small percentage of knowledge workers also use desktop databases.

Software decisions for personal computers determine hardware requirements. Major changes in software provided for the workforce should not be made without a thorough study of costs and benefits for the more than 60,000 Commonwealth users in 90 plus agencies including required changes in the hardware it runs on. Software upgrades may be done, but only with proof of cost-effectiveness (solid arguments and data).

Software support from the vendor generally spans about ten years for productivity software. Support for operating systems is typically less. Changes to the software on a computing device should not be made during the lifecycle of the device without clearly demonstrated business value and risk reduction that offset all associated costs.

Desktop Monitors

Monitors receive separate consideration in this standard because the choice of a replacement cycle for monitors provides an opportunity for savings. In the past, the lifecycle of a monitor has been ignored in the desktop replacement decision. Monitors typically are replaced based on the lifecycle of the computer itself, even though the monitor lasts longer.

Typical Users of Requirement Information for Personal Computing

When acquiring personal computing solutions, agencies typically choose among options that are on state contract. VITA or a contract solution provider would typically provide support. The typical users of the detailed information provided in this document would be those persons who design VITA services, determine contract specifications, or negotiate state contracts. The types of platform architecture requirements that will assist the Commonwealth in providing useful personal computing tool sets for agency personnel are, in part, the requirements for processes. The processes will ensure continuous reassessment of opportunities for cost-effective provision tool set improvements that add business value or are less costly.

Technical Trend Table Requirements for Personal Computing

Table 1 below provides the technical requirements for software, hardware, monitors, and selected peripherals. Table row headings indicate the requirement topic.

Table 1: Personal Computing Technical Requirements (December 2003)

Obsolescent	Transitional	Strategic	Emerging
OS Desktop/ Notebook Windows '95 Windows Me (not an enterprise OS) Windows 3.11 Windows XP (home)	OS Desktop/ Notebook Windows '98 Windows NT Workstation 4.0 Windows 2000 Macintosh OS 9	OS Desktop/ Notebook Windows XP Pro	OS Desktop/ Notebook Linux (kernel 2.4.20 on 1-20-03) ⁴ (test) Longhorn Windows (2004-5) Macintosh OS X
Productivity/ Management Software Microsoft Office '95; Outlook	Productivity/ Management Software Microsoft Office 2001; Outlook Express 5 (Mac) Microsoft Office '97; Outlook WinZip (compression now in Windows XP)	Productivity/ Management Software Microsoft Office 2003, Outlook (moved to strategic based on VITA testing and a waiver request submitted by VITA in 11-2004 on behalf of all agencies) Microsoft Office XP ⁵ ; Outlook Microsoft Office 2000 ⁶ ; Outlook Internet Explorer (highest) Adobe Acrobat Reader (and plug in)	Productivity/ Management Software Corel WordPerfect Office 11; Corel Central StarOffice 6.0 Open Office Microsoft Office V.x; Entourage (Mac) Netscape (highest) Open Source Browsers (e.g., Mozilla) Centrally managed services clients; centrally selected Antivirus
		Display Flat Panel Cathode Ray Tube; LCD; TFT ⁷ LCD - compatible with analog RGB interfaces	Display Mira ⁸ detachable monitor/pen tablet (Prototype) Flat Panels that use new digital interface DVI-I ⁹ (digital visual interface standard) and TMDS (transition minimized digital signaling)

⁴ See www.kernel.org for latest kernel.

⁵ Microsoft support for Office XP extends through June 30, 2011.

⁶ Microsoft support for Office 2000 extends through June 30, 2009.

⁷ Thin Film Transistor

Obsolescent	Transitional	Strategic	Emerging
Personal Computing Chipsets and Supported Interfaces Pentium II and earlier	Personal Computing Chipsets and Supported Interfaces Pentium III; Celeron; Power Mac G3; Power Mac G4 Old serial PS/2 parallel IDE is ATA 66, ATA 33	Personal Computing Chipsets and Supported Interfaces Pentium 4 ¹⁰ ; Athlon XP; Mobile Pentium III; Mobile Pentium 4 M ¹¹ Intel Centrino ¹² (chipset plus) USB 1.x; USB 2.0 ¹³ ; SCSI, FireWire or IEEE 1394 (serial); PCMCIA IDE is ATA 100; Serial ATA ¹⁴ 1.0 is primarily for internal PC storage PCI 2.2, PCI X 1.0	Personal Computing Chipsets and Supported Interfaces Hyper-Threading ¹⁵ (test) PCI Express ¹⁶ , PCI-X 2.0 and PCI 2.3 ¹⁷
Peripherals¹⁸ Zip Drive (Iomega) 5 ¼ Floppy	Peripherals CD ROM Jaz Drive (Iomega successor to Zip Drive) Floppy Drive (3.5)	Peripherals CD RW/ DVD ROM Combo Drive DVD ROM CD RW	Peripherals DVD (no standards agreed upon for DVD authoring) DVD-R; DVD-RW; DVD+R; DVD+RW

⁸ Viewsonic Mira is based on Windows CE.Net and uses the 802.11b wireless LAN protocol to maintain a connection between the monitor and the computer.

⁹ A good but technical article on DVI. http://www.ddwg.org/data/press/2001_04_26_edn.pdf

¹⁰ Pentium IV chipsets Intel 845GV, 845E, 845, and E7500, E7501 are current (see <http://www.intel.com/design/chipsets/embedded/> for details)

¹¹ For more information on power management and videoconferencing enhancements of the mobile chipset see <http://www.intel.com/products/notebook/processors/pentium4-m/index.htm?iid=sr+4>

¹² Centrino is Intel's Pentium M processor (formerly codenamed Banias), the 855 chipset and the PRO/Wireless 2100 Network Connection (currently an 802.11b solution). The chipset permits longer battery life in notebooks and in systems with wireless radios. The combination permits Centrino branding—although the connection solution will change.

¹³ USB 2.0 is fully backwards compatible with USB 1.0 devices.

¹⁴ Serial ATA 1.0 and II working groups <http://www.serialata.org/>

¹⁵ Hyper-threading is a feature of the Pentium 4 3.06 GHz chip. It enables one processor to appear as two. It should make Windows 2000 and Windows XP run better because they are designed to be multitasking. It is only for desktops and may cause some performance degradations. For this reason, it must be tested in a controlled environment before enabling the hyper-threading capability.

¹⁶ PCI Express may have no effect in the desktop arena. This may catch on in the server environment.

¹⁷ For more information on PCI see <http://www.pcisig.com/home>

¹⁸ Peripherals does not include printers (either personal or networked), scanners, printer/copiers, or similar devices at this time. These devices will be addressed at a later date if cost savings seem likely.

Obsolescent	Transitional	Strategic	Emerging
	Mobile Components Modems (V.34 and earlier)	Mobile Components Modems (V.90) IrDA—infrared PC Cards (PCMCIA) 802.11a cards (54 Mbps, OFDM, 5.5 GHz) 802.11b cards (2.4 GHz FHSS or DSSS) Bandwidth Combination Cards for 802.11 (a+b) e.g., Atheros	Mobile Components Modems (V.92 ¹⁹) Power management (DFM -Dynamic Frequency Management) SIM cards for client transmitters (subscriber identification module) for seamless roaming between different types of networks Bluetooth devices, 1Mbps, FHSS, 2.4 GHz ²⁰ 802.11g cards (54 Mbps OFDM, 2.4 GHz-standard ratified in July, 2003) Bandwidth Combination Cards for 802.11 (a+g, a+b+g) e.g., Atheros
	OS PDA, Pen, etc. ²¹ Palm OS (current and older versions do not support enterprise needs)	OS PDA, Pen, etc. Blackberry OS (RIM)	OS PDA, Pen, etc. Palm OS (future revisions may have business oriented features) Symbian OS 6.0 (Smart Phones) Symbian OS 7.0 (Beta) EPOC = Symbian Windows CE (Handheld PC) Windows CE .Net (Beta)
	Related Hardware/Media Floppy disks 3.5”	Related Hardware/Media Key Storage (uses USB port as writer/reader)	

Requirement Statements

The requirement statements below reiterate information in the strategic column of Table 1 and/or provide information about how architectural decisions will be made or updated in the future to ensure that agency business needs will be met. Roles of VITA and affected agencies in the decision processes are noted.

¹⁹ V.92 supports quick connect, modem on hold, and 48K upstream transmission.

²⁰ Bluetooth is presently too expensive compared to IrDA and other methods for connection. For a good discussion of Bluetooth technologies see <http://www6.tomshardware.com/network/20020626/bluetooth-09.html>. This article recommends TDK implementations of Bluetooth.

²¹ The architecture does not address pen tablets or cell/PDA combination devices at this time.

Personal Computing Requirement Reviews: *Enterprise Architecture Staff shall convene a personal computing platform domain team meeting twice annually to review personal computing technical trend recommendations and provide revisions as needed.*

The team shall review the target architecture recommendations for personal computing and study critical issues in-depth. The team shall be comprised of individuals knowledgeable in personal computing areas including: business needs, technologies, procurement, price negotiations, deployment, maintenance and support.

Personal Computing Metrics: *To strengthen policy input for VITA decision makers, VITA staff shall devise and track metrics on personal computing devices for executive branch agencies.*

Metrics may include costs, customer satisfaction, and environment mix within and across agencies. VITA staff should use sampling methods, procurement systems, help desk statistics, expenditure data, and aggregate statistics where possible to reduce metric estimation costs.

Centralized Personal Computing Decisions: *VITA staff shall examine cost and benefit data for personal computing in the aggregate (i.e., across agencies). A decision that provides the best savings across agencies may not always provide the best savings in every agency. VITA staff must have the flexibility to implement the simpler solution that significantly benefits most agencies and users.*

VITA shall centralize personal computing decisions regarding what may be procured, how frequently devices may be refreshed, how agency support is to be provided, what security methods are acceptable, and what methods of email access (e.g., wireless [push email](#) systems for PDAs) may be used.

Personal Computing Business Needs Assessment: *As certain decisions regarding personal computing platforms move from agencies to VITA, VITA shall ensure an annual or more frequent process for assessing the changes in personal computing business needs within and across agencies.*

Personal Computing Support: *VITA shall provide location-based personal computing support options for geographically dispersed agency groups when central services are inadequate to meet customer needs. Costs and benefits of location-based services must be separately evaluated.*

Personal Computer Monitors: *Because desktop displays have a longer lifecycle than the computers they support, their replacement shall not be automatic at the time of a desktop replacement. Display replacement decisions for all agencies including administrative units of higher education must be based on customer business needs, support considerations, cost-of-ownership data, and hardware compatibility considerations. VITA shall provide separate display acquisition pricing. Also, VITA shall provide cost-benefit data and display selection criteria for CRTs and flat panel monitors.*

Personal Computing I/O Media: *When establishing minimum bid specifications for personal computers, VITA shall include CD writers as standard output devices. Floppy drives and DVD readers should be optional. The acquisition of DVD writers shall be discouraged until a single standard is ratified. This requirement applies to agencies including the administrative units of higher education.*

Personal Computing Productivity Software: *VITA shall determine the productivity software needs in the Commonwealth (e.g., percentage of the workforce that requires various combinations of the individual office software offerings including word processing, presentation, spreadsheet, and database software) for considering the most cost-effective desktop, laptop, PDA, and [base image](#) alternatives.*

Needs information can be used in estimating the costs of personal computing alternatives and the costs of modifying the desktop base image for those groups needing additional personal or agency functionality.

Personal Computing Antivirus Software: *Enterprise Architecture Staff shall periodically convene a team to determine the best antivirus software for inclusion in a desktop base image given: relative protection levels provided, how updates are accomplished, maintenance costs, impact on the network, company history, company plans, and software/license costs. The decision must be coordinated with the network antivirus engine selection decision. The team shall involve members of the Platform, Network, and Security Domain Teams. Agencies should use a highly rated antivirus software (e.g., by Norton (Symantec), McAfee, Panda, PC-cillin, or Eset) until the Enterprise Architecture recommendations are released.*

Personal Computing Productivity Software: *The Commonwealth's target personal computing software architecture for new desktops and notebooks for all agencies including administrative units of higher education shall include: Microsoft Office Professional (2000 or XP), Internet Explorer, and Adobe Acrobat Reader. This software is to be provided in the standard desktop image for the Commonwealth executive branch workforce including administrative units in higher education. This standard shall remain in effect until cost effectiveness of an alternative is confirmed by a Virginia study of alternatives and price negotiation results.²²*

Personal Computing Software Base Configuration and Lockdowns: *VITA shall develop starting point, typical base images for the most commonly needed desktop and notebook computer types to reduce setup decision making and costs. This should include appropriate software setup and system lockdown policies.*

Personal Computer Operating System: *The Enterprise Architecture establishes Microsoft Windows XP Pro as the present target operating system for Commonwealth desktops and notebooks. This standard shall apply to all agencies including the administrative units of higher education and shall remain in effect until cost effectiveness of an alternative is confirmed by a Virginia study of*

²² Errata: the second repetition of the word including was erroneously typed as excluding. It has been corrected here

alternatives and price negotiation results. (Note that the support lifecycle for Windows XP Professional is as follows: product availability—December 31, 2001; mainstream support—December 31, 2001 through December 31, 2006; extended support—December 31, 2006 - December 31, 2008. Computers acquired in January 2005 would be beyond extended support at the end of a 4-year lifecycle. An alternative strategy would be needed by this time.)

Personal Digital Assistant Needs: *The Enterprise Architecture team recommends that VITA conduct a comprehensive study of PDA needs, functions, benefits, and costs. The study team should include platform domain participants, network domain experts, PDA support and PDA users. The Enterprise Architecture team will use this information to recommend future PDA directions for the Commonwealth. Because PDA product and service offerings change frequently, this group should review its recommendations twice annually.*

Personal Digital Assistant Devices and Services: *The Enterprise Architecture team recommends that all agencies use the Blackberry device for both low- and high-end PDA services until VITA completes a comprehensive study of PDA needs and costs.*

The Blackberry device has a useful feature set with or without the push email services for which it is known. The benefits of using the same device for low and high-end services is reduced support staff training costs, transfer of customer skills for customers moving from low- to high-end services, proven implementation of high-end services in Virginia government, and anticipated cost effectiveness if offered to appropriate users as part of a planned tool set.

Personal Computing Lifecycle: *Enterprise Architecture recommends that agencies including the administrative units of higher education change the desktop lifecycle to four years for one full year beginning in the 2004 Fiscal Year. During this year, VITA can study support costs for a sample of the four-year-old machines and determine whether annual support cost increases offset annual savings from reduced acquisitions. VITA can then recommend either a return to a three-year refresh cycle or continuance of the four-year refresh cycle following the study.*

Servers

Servers include mainframe computers and computers that function as service-providers in a client-server network. Excluded are hardware devices that function as both client and a server in a peer-to-peer network, bridges, and routers. A server solution may include single servers, virtual servers, clusters, farms, server blades, n-tier applications solutions and hosted application solutions. Server configuration capabilities, management options, and shared use options are important considerations in the selection of server types to be included in the Commonwealth's desired architecture.

Servers include hardware and software as follows: operating systems, remote access software, CPUs, ports/interfaces, communications buses, memory, storage, power, controller components and I/O devices,

Typical Users of Requirement Information for Servers

Agencies and their consultants are the main authors of detailed technical requirements for server solutions, but both the authors of requirements and the central managers of the servers (i.e., VITA) must be aware of architectural restrictions in this document. The reason for this dual responsibility is that servers may be acquired for a particular agency application or for a consolidation of agency applications. Agencies including the business units of higher education are bound by requirements in this document unless they have applied for a waiver²³ and been granted an exception.

Agencies with business applications (or VITA on behalf of agencies) will typically procure servers from state contracts to address very specific business and operational needs or procure services on a centrally managed consolidation platform (a server which supports multiple applications and/or application tiers). Agencies (or VITA on behalf of agencies) may also procure hosting services. Other frequently used avenues are the procurement of servers, application-development solutions, turnkey solutions, or application hosting solution via requests for proposals (RFPs). These RFPs must reference platform architecture requirements in this standard.

VITA has been tasked by the General Assembly to provide for the centralized management of agency servers and provision of consolidation platforms. VITA is interested mainly in the joint management capabilities for server solutions, support contracts for servers, I/O capabilities, network connection capabilities, remote management capabilities, energy usage, heat considerations, and footprint/density issues.

VITA procurement experts typically establish the contract options. For servers, a typical contract would list server offerings for a vendor and percentage discounts.

Agencies have existing server architectures (i.e., platforms and operating systems designed to meet the specific business needs of their applications) that were in place prior to efforts to centralize server support and investigate additional consolidation alternatives. Decisions regarding operating systems updates, software updates, hardware replacements, and new platform acquisitions are part of the agency's information technology strategic plan.

Each agency must plan for eventual movement from their existing server architecture to the Commonwealth's desired architecture if differences exist. The desired architecture is specified by requirements in this standard. Whether this is done when hardware becomes outdated, when major investments are needed due to changing requirements (e.g., a need to [scale up](#) or [scale out](#)), or when applications are replaced or significantly modified is a decision that must be made by the agency based on cost and benefit analyses done application by application.

Technical Trend Table Requirements for Servers

The topics addressed in the table include:

- Technologies for server management and consolidation
- Consolidation platforms

²³ Waiver applications are explained in greater detail at the end of this document.

- Interconnections between processors in a multiprocessor solution
- [High-end server](#) platforms
- [Midrange to low-end](#) server platforms
- How the Linux operating system should be used in the Commonwealth

Table 2: Server Technical Requirements

Obsolescent	Transitional	Strategic	Emerging
	Technologies for Server Management & Consolidation Virtual Machine Creation Software for transitional support of OS environments not in the strategic architecture	Technologies for Server Management & Consolidation Workload Management Software for high-end and some midrange for increasing resource usage efficiencies (Native and 3 rd Party) Virtual servers (resource provisioning across applications) and virtual machines (server partitioning for different OSs or multiple OS copies): available for servers and blade solutions; use of resource provisioning for increasing resource usage efficiencies; use of virtual servers in partitions for reducing licensing costs on IBM zOS via Linux use; use of partitions for creating segmented development, testing, training, etc. environments by running multiple OS copies. Hardware Partitioning via OS (Static and Dynamic) dynamic permits ease of resource provisioning changes Fault tolerance via design redundancy and hot swapping Clustering; Parallel Sysplex for IBM mainframe Load Balancing Remote Management Blades ²⁴ (not proven for all types of uses) Provisioning Blades ²⁵ Blade repurposing/Image distribution	Technologies for Server Management & Consolidation Geographic Failover (emerging due to costs) Hyper-threading (HT); simultaneous multithreading (SMT) switched multi/single threading ; (CMT) chip multithreading (not yet fully tested or in development). Dual core chips with multithreading Network is Server (managing resource sharing)

²⁴ Blade solutions may not be cost effective.

²⁵ Provisioning blades are new technologies from Sun (N1-Provisioning Blades).

Obsolescent	Transitional	Strategic	Emerging
Consolidation Platforms <i>Scale up: midrange to high-end platforms</i> MPE MVS OS 390 Unisys OS2200 VMS OS/400 IBM ES9000 (9221) AIX	Consolidation Platforms <i>Scale out: Virtual Servers</i> Permit Windows NT as a transitional strategy Permit virtual servers of older versions of supported OSs in transitional efforts	Consolidation Platforms <i>Scale Out: Virtual Servers/Virtual Machines</i> Permit Windows, Solaris, HP-UX, or Linux virtual machines and virtual servers in scale out solutions provided via zVM, Connectix, or VMware. <i>Scale out: 32 bit CISC (IA); 64 bit RISC; IBM high-end virtual servers—farms/clusters using blades, server appliances, and servers</i> Permit Windows, Solaris, HP-UX, and Linux as candidates for acceptable uses Appropriate for MS Exchange Server (Email Farm): clustered low-end to low midrange solution on Windows Server 2003 Enterprise (upon testing). Note: Active Directory as directory of choice if MS Exchange e-mail solution used. Appropriate as tier for single large databases—e.g., Oracle real application clusters (RAC). Appropriate for Web hosting: (e.g., on Windows Server 2003, UNIX or Linux) <i>Scale up: midrange to high-end platforms</i> Permit Windows, UNIX and zOS as candidates for high-end and midrange consolidation (Windows may not compete seriously until 2006 according to GartnerGroup ²⁶) Appropriate for critical application and database tiers Recommend DBs to run on separate tier from the applications they serve (platform or partition that does not include the application). <i>All new platform hardware</i> Regardless of manufacturer, if not currently in use in VA's architecture, architectural fit must be examined and cost/benefits studied	Consolidation Platform <i>Scale out: 64 bit EPIC (Itanium)</i> Use after applications retooled and after proven cost effective (highly cautious use). e.g., for SQL DB—next version is 64 bit (Yukon) e.g., for MS Exchange—next version (Titanium) is still 32 bit but following version will be 64 bit (Kodiak). Note: 32 bit applications may not run as well on 64 bit servers even though the chipset is backwards compatible. Note: Virginia's IBM mainframe has not been upgraded from 32-bit to 64-bit processing. The current IBM applications and anticipated future needs on the mainframe do not require the improved addressing capabilities.

²⁶ Gartner Group, Unix and Windows Datacenter Enterprise Servers. Technology Overview, July 1, 2003; "The availability of these 64-bit servers, 64-bit versions of Windows Server 2003 and, crucially, a 64-bit version of Microsoft's SQL Server database management system (DBMS) is expected to increase the competitiveness of Windows as an alternative to Unix. It will certainly prove a challenge to RISC/Unix in terms of initial hardware

Obsolescent	Transitional	Strategic	Emerging
Interconnects Serial Ring NUMA; ccNUMA	Interconnects PCI 2.2, PCI X 1.0 Peripheral Component Interconnect)	Interconnects Crossbar NUMA/SMP-NUMA architecture for midrange to high-end PCI Express, PCI-X 2.0 and PCI 2.3 HyperTransport (AMD's point-to-point link for interconnecting integrated circuits on a board) Other current high-end server internal interconnection technologies including proprietary methods	Interconnects InfiniBand RDMA and 10GB Ethernet will blur lines between servers and their resources on networks 10GigE for blade servers Serial switched fabric for modular servers (e.g., InfiniBand, HyperTransport)
High-End Servers MVS XA MPE	High-End Servers MVS OS 390 Unisys OS2200 VMS OS/400 (library OS) UNIX other than Solaris and HP- UX IBM ES9000 (9221) Virtual servers of older versions of a strategic OS	High-End Servers z/OS, Solaris, HP/UX, and Linux only Virtual Server OSs (e.g., zVM, Connectix, VMware) strategic only for supporting OSs that are in the desired future architecture (e.g., Linux, Windows 2003, and UNIX) Virtual server use to aid in building test environment setup IBM zOS, Sun Solaris ²⁷ , and HP/UX RISC platforms are strategic. Hardware alternative to the above three platforms may be considered only if they are fully compatible, provide equal or better performance for all application and architectural requirements, and introduce no problems to the Virginia architecture other than those that may be cost- effectively resolved.	High-End Servers Windows Datacenter (both 2000 and 2003 versions) will not be strategic initially due to lack of data on its effectiveness, but the 2003 version will move to strategic by 2005 when more applications can take advantage of 64 bit chipsets Several Intel/AMD platforms will be candidates including IBM, Sun, HP, and Unisys platforms

and software acquisition costs, although the lack of ISV applications ported to the 64-bit Windows platform, skepticism about Windows security and less advanced manageability will retain the balance in favor of high-end RISC/Unix until at least 2006 or 2007 (0.7 probability). Windows also faces its own price/performance challenge from Linux and Oracle 9i [RAC](#) clusters. Initially running on four-way IA-32 nodes, three- or four-node Oracle RAC clusters running on four- or eight-way Itanium-based servers could offer a price/performance challenge to high-end Windows that is more in keeping with the small-server Windows ethos. Oracle RAC clusters could provide an even greater price/performance challenge to Unix SMP, however.”

²⁷ Both Sun and Fujitsu provide high-end hardware for the Sun Solaris operating system.

Obsolescent	Transitional	Strategic	Emerging
Midrange/ Low-end Servers NT 3.51 Novell earlier than 4.x	Midrange/ Low-end Servers NT 4.0 Novell 5.x—6.x OSX Novell 4.x and earlier Virtual Server OSs (e.g., Connectix, VMware GSX and ESX) enable transition strategies for multiple versions of the same OS such as NT and 2000 Windows MS Exchange servers	Midrange/ Low-end Servers Windows 2000, Advanced Server, (especially for domain controllers, file, print, and email) Windows Server System (2003 Standard and Enterprise Editions) –begin use with outwardly facing servers for security improvements and in clustering solutions. Datacenter with 32 bit processors only (if track record for the solution indicates cost-effective) Solaris and HP-UX are candidates for high-end and midrange business Virtual Server OSs (e.g., Connectix, VMware GSX and ESX) become critical part of consolidation strategy and aid in test environment setup Linux (especially for Web) Server appliances can be highly cost-effective for cache, web serving, storage, and other purposes Traditional server units in racks remain strategic Server blades are slowly becoming contenders All manufacturers compete for midrange hardware.	Midrange/ Low-end Servers Windows Datacenter (both 2000 and 2003 versions) will not be strategic initially due to lack of data on effectiveness, but the 2003 version will move to strategic when proven
		Role of Linux on Low to High- end Platforms Linux as a database OS (e.g., Oracle runs on Linux) Linux as an application OS, initially for selected utilities including web hosting running on low end servers or in soft partitions on midrange or high-end servers (if possible following lawsuit) Linux for selected business applications Note: Use of open source free software may pose a risk to the Commonwealth that could be avoided by adopting an industry supported version such as Red Hat ²⁸	Roll of Linux on Low to High- end Platforms Linux for business critical applications Linux as the managing OS or host OS for multiple partitions or multiple servers in a cluster or frame

²⁸ SuSE, MandrakeSoft, Debian and others are also industry supported.

Requirement Statements for Servers

The requirement statements below reiterate information in the strategic column of Table 2 and provide information about how the Commonwealth will balance competition and architectural simplification through the design of its desired future server architecture. Roles of VITA and agencies are indicated both by the term “Virginia” and by specific reference. Additional operational requirements are addressed in the Information Technology Resource Management (ITRM) policy for platforms and the *Platform Architecture Report*.

Server Operating Systems Simplification: *Virginia shall limit OSs in its architecture to zOS, Solaris, HPUX, Linux, Windows and virtualization OSs for all future platform acquisitions.*

Virginia shall exclude the following operating systems from scale up contention: MPE, MVS OS 390, Unisys OS2200, VMS, AIX and OS/400.

Virginia shall consider only Solaris, HPUX, and zOS for near-term scale-up solutions.

Virginia shall limit scale-out consolidation platform OS contenders to Windows, Solaris, HPUX, and Linux.

High-end Server Hardware Competition: *Virginia wishes to encourage hardware competition when compatible hardware is an option. When considering hardware alternatives for existing applications that are on high-end platforms, Virginia’s agencies, including higher education administrative units, must require “plug-compatibility” for the applications. In most instances, the hardware and OS for a high-end server are acquired as a unit from the same manufacturer. When hardware options are possible for a particular OS, Virginia’s agencies must take care to ensure that the different hardware alternatives do not introduce variables that would change application resource management strategies, application portability, database portability, etc. The alternative must be in line with Virginia’s total planned architecture. Bid requests for consolidation platforms must specify all required elements of management, maintenance, and software systems compatibility.*

Servers that Provide Network, File and Print Services: *Servers in the Commonwealth that provide local area network services (e.g., domain control), file services or print services must use the same operating system to facilitate central management and central consolidation opportunities. The Enterprise Architecture establishes Windows 2000, Windows 2000 Advanced Server and Windows 2003 as the target architecture standard for these servers. This standard shall remain in effect if appropriate central management systems and consolidation options are available, and if cost effectiveness is confirmed by a Virginia study of alternatives and price negotiation results.*

Email Servers: *VITA shall examine the feasibility, costs, and benefits of standardizing on Exchange as an Email Server. The study shall consider whether centralizing email is cost effective and whether standardizing on Microsoft Exchange or another enterprise solutions is cost effective. With network services*

standardized across agencies, opportunities for providing central utilities improve. Resource directories including those related to email may be centrally controlled and locally managed.

Maintenance Agreements for Servers: *Individual agencies, including higher education administrative units, and VITA shall ensure that servers are under a maintenance agreement for the planned life of the server.*

File Server Alternatives: *Individual agencies, including higher education administrative units, and VITA shall examine consolidated storage alternatives whenever considering acquisitions of file servers.*

Exceptions to Promote Cost-Effective Regional and National Solutions: *To promote cost-effective reuse of applications developed for other states and for governments generally, the Enterprise Architecture shall permit consideration of platforms not in the desired architecture. A specific OS may be part of the only proven implementation for selected reusable business applications, and the flexibility to choose proven solutions must be permitted. Exceptions should be provided to all agencies when warranted including higher education administrative units.*

Storage

Storage refers to the combination of technologies that together enable making a record of business data, which can be indexed and retrieved by servers and clients that need the information. Storage solutions overlap to some extent with the server category. Common combinations of technologies designed to meet storage needs are referred to in this standard as storage models. The storage models are scalable solutions that are typically external to application servers. Included are file servers, network-attached storage (NAS), storage area networks (SANs), and Direct Attached Storage (DAS). These models all use a variety of media (e.g., tape, disk, and CDs) and interfaces.

Typical Users of Requirement Information for Storage

Agencies and designers of central utility services make storage system decisions for the Commonwealth. Once central utility services or outsourced storage alternatives have been designed and implemented, agencies will have new options to consider.

Agencies have an existing architecture to meet their storage requirements. The storage solutions agencies employ are typically application specific and dedicated to a server or a cluster of servers that serve one application. Agencies are responsible for the creation and maintenance of business applications and the selections of storage solutions for them.

Those who centrally manage servers and their storage also have the opportunity to consider storage alternatives. The availability of central solutions will assist both server managers and agencies in considering storage alternatives.

In the past, large agencies have had more opportunities for considering storage solutions that are not dedicated to a single server. Especially in the instance of SANs, considerable storage volumes are required before cost-effective solutions can be designed.

VITA procurement experts may also use storage requirements in their selection of service and solutions to place on state contract. These experts would also place the component parts of end-to-end solutions on state contract.

Technical Trend Table Requirements for Storage

The technical topics covered in requirements Table 3 include the following:

- Interfaces between storage solutions and the applications that use them
- Control options for storage solutions
- Disk storage options
- Tape storage options

Table 3: Storage Technical Requirements²⁹ (December 2003)

Obsolescent	Transitional	Strategic	Emerging
	Interfaces Block/Parallel (distance limits and speed problems) 4.5 Mbps (Mainframe) ESCON, 17 Mbps (Mainframe) 10/100 Ethernet	Interfaces FIBRE Channel -FC, FC-AL (fiber channel arbitrated loop) FICON SCSI 10/100/Gb Ethernet 10/100/2Gb Ethernet	Interfaces iSCSI (standard for IP wrapped SCSI is in the final stages of the standards approval process; security concerns) ³⁰ InfiniBand (IB) ³¹ PCI Express FC-IP 10GigE
		Controllers SAN Fabric Switch NAS Controller (simplified OS) DAS (attached server's OS) DAS Controller Network File Server OS NAS Gateway to SAN Add-on Storage Management Software	Controllers SAN/NAS unified controller (hardware/software combination)

²⁹ Requirements in this table apply to executive branch agencies, including the administrative units of higher education.

³⁰ See Network World, <http://www.nwfusion.com/news/2003/0127iscsi.html>, IP Storage Standard Set to Roll, 1-27-2003.

³¹ InfiniBand is a high-speed, bi-directional, serial computer bus, intended for both internal and external connections. The future of this technology is uncertain.

Obsolescent	Transitional	Strategic	Emerging
Disk Storage Hardware SLEDS (single large expensive disks once used by all mainframe computers for storage)		Disk Storage Hardware External Controller-based RAID ATA Disks Disks CDs	Disk Storage Hardware DVD (awaiting write standards)
Tape Technology 9 track 18 track	Tape Technology 36 track DLT (digital linear tape) AIT (advanced intelligent tape)	Tape Technology LTO (linear tape open) SDLT (super digital linear tape) Virtual Tape (Disk) Magstar (IBM 3590; STK 9x40)	Tape Technology Terabyte tapes

Requirement Statements Applying to Storage Solutions

Agency Capacity Planning and Storage Planning Data: *VITA shall require that agencies provide periodic capacity planning and storage planning data. The availability of planning data will improve agency and central storage solutions and backup and disaster recovery solutions.*

Feasibility of Central Storage: *VITA Staff shall use information from agency capacity and storage planning to investigate the feasibility of providing central storage utility services.*

Storage for Utility Service: *To reduce escalating storage costs, VITA shall consider storage consolidation opportunities when considering utility services for central handling. Potential utility services that would have large storage needs and/or growing storage needs are email services and Web hosting services.*

iSCSI Storage Connections: *VITA shall explore opportunities to provide cost-effective, centrally managed storage services that can meet the needs of small and medium applications across agencies.*

Note: At present, it is generally cost-prohibitive to attach servers of small applications to a SAN. As iSCSI becomes a recognized standard and iSCSI storage becomes more readily available, the use of this protocol will drastically reduce connection costs and increase the likelihood of having central storage for the application servers of all agencies. iSCSI allows the substitution of inexpensive devices (e.g., Ethernet devices) for expensive Fibre Channel devices and the transmission of storage traffic over existing local and wide-area networks. What this means to storage planning is that one solution may meet a broader range of needs in a cost-effective manner.

Storage for Co-located Servers: Whenever remote consolidated storage options are cost-prohibitive, VITA and other agencies that manage storage, including administrative units of higher education, must evaluate the cost-effectiveness of local consolidated storage options for the physically collocated servers under their control.

Capacity Planning and Storage Planning Services: VITA must offer capacity planning and storage planning services to assist agencies in determining their future requirements.

Requirement Statements Applying to All Platforms

This set of recommendations crosses platform types.

Security as a Priority Factor in Decision Making for Platforms: VITA shall consider business security requirements up front when making decisions for all platforms from personal computing devices to enterprise servers.

Interchangeable Components as a Priority Design Factor: VITA shall design systems with interchangeable components to support field servicing of hardware and software.

Remote Management as a Priority Design Factor: VITA shall design platforms for remote administration, diagnosis, and systems management.

Platform Refresh Decisions and Procurement Leverage: VITA shall centralize acquisition controls for all platforms acquired in large volumes across executive branch agencies to leverage procurements, improve interagency homogeneity, and provide equitable refresh plans within dollars allocated³².

Central Test Laboratory Services: VITA shall deploy a central lab for use in: 1) testing emerging platform technologies and their general applicability to the Commonwealth's computing architecture; 2) partnering with individual Commonwealth entities to provide a focused approach for matching technology solutions with identified business needs; and 3) communicating results to stakeholders.

³² Note that this requirement applies to personal computers, servers, and storage platforms.

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Waivers

Platform acquisitions not in line with this standard require the granting of an exception based on an application for a waiver. The waiver application must provide a business case that clearly weighs all relevant costs and benefits and demonstrates a better return on investment for the alternate architecture. The business case must demonstrate that following the requirements herein will result in failure to meet agency business needs in a cost-effective manner. Any waiver granted will be time-limited to encourage periodic reassessment. Also, the waiver may stipulate conditions including the provision of performance data at the cost levels claimed for the alternative.

The waiver request along with supporting arguments and data should be addressed to: N. Jerry Simonoff, Director of Vita Strategic Management Services, 110 South 7th Street, Richmond VA 23219

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Glossary

Base Image –used in this report to indicate a starting point for a hard disk image that may be used as is or further modified to meet agency user needs with users placed in as large a base image group as possible based on commonality of requirements. All secretaries might have one base image and all programmers, another. The image is a copy of the configured operating system and software on the desktop, laptop or other device. Microsoft provides instructions for establishing, compressing and distributing such images. See below.

“Some organizations deploy a complete user system at one time, including Microsoft® Windows® software, device drivers, Microsoft Office 2003 applications, and custom settings. In this scenario, you install the entire system onto a test computer, and then you create an image of the hard disk to copy to users' computers.

Installing Office with a complete user system is almost as fast as installing Office by itself. It is a particularly efficient way to configure new computers or to restore a computer to its original state. When you distribute the hard disk image to users, everything on the computer is replaced by your custom configuration, so users must back up any documents or other files they want to keep.”

Emerging – rating used in this document to classify technologies. The Virginia Enterprise Architecture promotes only evaluative deployments of this technology. This technology may be in development or may require evaluation in government and university settings.

High-end Server – defined as servers with a greater than 16 processor scale-up limit and typically costing more than \$250,000.

Midrange to Small Server - in this report, servers costing \$50,000 or less are typical midrange to small servers. These servers would usually have one to four processors, but could have as many as 8 or 16 processors. When the midrange computer is a scaled-down version of a high-end server, it may cost substantially more.

Obsolescent -rating used in this document to classify technologies. The Virginia Enterprise Architecture actively promotes that agencies employ a different technology. Agencies or Central Services Staff should not plan new deployments of this technology. Agencies and Central Services should develop a plan to replace this technology. This technology may be waning in use or no longer supported

Personal Computing – devices and device components for desktop computers, notebooks and handheld computers including operating systems, hardware components, productivity software, and security software.

Platform Architecture - defines the personal and business computing hardware systems to be used by agencies. The platforms may include servers (e.g., high-end servers and midrange to small servers), storage systems, personal computing devices (desktops, notebooks, and hand-held computing devices), and other hardware (e.g., printers). In addition to platform hardware, the Platform Architecture addresses operating systems, configurations, network and device-to-device interfaces, and selected peripherals (e.g., floppy drives). In the

instance of personal computing devices, the architecture also addresses base productivity software, security software, and utilities that are necessary to make the hardware useful to users. The architecture addresses decision criteria and best practices for the acquisition and deployment of platforms. The architecture also identifies management and remote access components, which are critical to platform use. Details regarding management components are addressed in the Systems Management Domain.

Productivity Software - software typically used by business professionals such as word processing, spreadsheets, presentation slides, web browsers, and plug ins. Also includes lesser used software such as personal database software, flowcharting, project management.

Push Email – a self-synchronizing exchange between an email server and typically, a wireless device that enables updates to mail without a user request for the update. This is usually accomplished by synchronizing software on a special enterprise server or user's desktop computer and on the wireless device.

Scale-Up Solutions -1) from an application perspective, a scale-up solution is one that permits the adding of more resources to the application by adding resources from within a single platform and without increasing the number of operating systems used in supporting the application. 2) for the consolidation of multiple applications, the scale-up solutions will provide the

ability to add resources to more than one application from within the platform without increasing the number of operating systems used in supporting the application.

Scale-Out Solutions - from an application standpoint (e.g., email), the scale-out solution increases resources to the application by adding servers to the cluster of real or virtual servers. The addition of servers increases the number of operating systems supporting the solution.

Server –a computer which provides some service for other computers connected to it via a network.

Storage – computer storage is the holding of data in an electromagnetic form for access by a computer processor. Primary storage is data in random access memory (RAM) and other "built-in" devices. Secondary storage is data on hard disks, tapes, and other external devices.

Strategic – a technology or protocol rating used in this document. Ratings of strategic instruct agencies as follows. The Virginia Enterprise Architecture promotes use of this technology by agencies. New deployments of this technology are recommended.

Transitional - rating used in this document to classify technologies. The Virginia Enterprise Architecture promotes other standard technologies. Agencies may be using this technology as a transitional strategy in movement to a strategic technology. This technology may be waning in use or no longer supported.